CLOSURE PLAN CONTENTS AND TECHNICAL REVIEW

3.8 - SOIL SAMPLING PLAN

Introduction

The primary purpose of the soil sampling section of the closure plan is for the facility to explain how they intend to prove that there have not been releases of hazardous wastes or constituents to the soils under and around the regulated waste management units. This type of sampling is called confirmation sampling and it must be approved by the permit writer during review of the closure plan. There are other types of soil sampling that may occur after the closure plan is approved and they are described in Chapter 5 (section entitled "Site Characterization Sampling"). Again, the burden of proof is on the facility to verify that there have been no releases. This confirmation soil sampling section should include all of the following elements:

- General description of confirmation soil sampling;
- Sampling locations and depths;
- Types of soil samples;
- Sample collection methods;
- Quality control samples;
- Chain-of-custody;
- Sample labelling, packaging, and transportation; and
- Documentation.

Submittals Required by Applicant

1. General Description of Confirmation Sampling - This is a description of the sampling the owner or operator would propose to prove that there have not been any releases from the regulated waste management units. The permit writer should not assume there have been releases but allow the facility to provide proof through this logical sampling procedure to "confirm" any releases. Confirmation sampling is used to determine whether spills, leaks, overtopping, or other releases of hazardous wastes or constituents from waste management units have occurred.

2. Confirmation Sampling Locations and Depths - Each type of soil sampling listed above should include identification of, and the rationale used to determine, the sampling locations and depths. All sampling locations should be indicated on a facility map. There are two possible approaches to selecting sampling locations. One is to take biased (i.e., predetermined) sampling in logical spots where if a release occurred, these spots would give a good indication. The other possibility is random sampling. Review of other guidance literature has not indicated a preference for either approach.

Biased Sampling - A minimum of five sample boring locations are recommended at each waste management unit to assess if releases of hazardous wastes or constituents into the soil have occurred. These boring locations may be situated at the mid-points of all four sides of the secondary containment system and at the center of the waste management unit. If several waste management units share the same secondary containment system (i.e., a tank farm with ten separate tanks), additional boring locations should be situated directly below each unit. In addition, sample borings should be located beneath all sumps within the containment system.

In order to assess the vertical migration of hazardous wastes or constituents, soil samples should be taken at a minimum of three depths for each sample boring location required above. These depths may be at the containment system/soil interface, three feet, and six feet below the interface. Some containment systems may have been constructed on top of a layer of gravel, the owner or operator should then readjust the sampling depth to suit specific site conditions.

Random sampling - See Appendix B for a random sampling procedure to determine a sample location. However, for each chosen location a minimum of 3 depths as described above are recommended.

3. Types of Soil Samples - Grab samples are preferable to composite samples because grab samples provide specific data for a discrete location. Composite samples typically cannot identify hot spots. Additionally, compositing samples allows some volatile organic chemicals to be released which will skew the results. The soil sampling plan should include a description of the types of samples obtained (or to be obtained) and a rationale for the selection of sample types.

4. Sample Collection - The owner or operator should describe the techniques and devices used for soil sample collection. The following criteria should be considered when selecting soil sampling techniques and devices:

! The number of samples to be collected, sampling locations, and sampling depths.

! The physical properties of the soil (e.g., grain size, cohesiveness, homogeneity, and presence of anomalies, such as animal burrows, large rocks, or plant roots). Certain samplers which work well with soft, fine-gained soils may not work with hard, rocky soils.

! Thickness of the soil layer above the bedrock or water table which may limit the depth from which samples can be collected.

! The amount of sample required. The minimum sample size is specified by the laboratory on the basis of the analytical method and the required sensitivity of analysis.

! The types of elements or compounds for which the samples will be analyzed. This consideration may preclude the use of samplers made of certain materials (e.g., certain metals, PVC).

! The samplers should be assessable to the sampling locations and relatively easy to use and clean.

a. Sampling Devices - The owner or operator should provide the rationale in selecting different types of sampling device. The following sampling devices may be used for soil investigation:

! Shovel or Trowel - Surface soil samples can be collected using a shovel or trowel. The sampler should be made of rust resistant material or stainless steel. Plated and painted samplers should be avoided if soil samples are to be analyzed for total metal contents.

! Soil Probe - The soil probe (often called a King-tube) is designed for shallow subsurface sampling up to about six feet in depth. The soil probe is a stainless steel or brass tube that is sharpened at one end and fitted with a long, T shaped handle. The tube is manually pushed into the soil in approximately six inches increments to a targeted depth. A relatively undisturbed soil core is then removed from the probe and placed in the sample container.

! Hand Auger - A hand auger is used to take samples to about ten feet below surface. The auger consists of sharpened spiral blades attached to a hard metal central shaft. The auger is twisted or screwed into the soil and then extracted. Sections of the soil column are extracted to a desired depth. Consecutive soil columns are pulled from the same hole thus cross-contamination is possible. One variation of this device is a sleeved bucket auger, which has a removable plastic, stainless steel, or teflon sleeve insert. The sleeve is removed and capped after the sample is taken. Sleeved bucket auger is advantageous over other devices when volatiles are suspected in the soil sample.

! Power Auger - The equipment required for power auger usually consist of large, vehicle mounted augers and boring devices although there are some small tripod mounted coring units available. The object of the sampling is to take a series of 18 to 24 inch undisturbed cores with a split spoon sampler.

A six-inch auger is used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augered hole and the core extracted.

For most circumstances the use of hollow-stem augers with some type of cylindrical sampler will provide a greater level of assurance that the soil being sampled was not carried downward by the hole excavating or sampling process. For some situations, such as sampling dense to very dense or stiff to very hard ground, the use of multipurpose auger-core-rotary drills will be necessary. For some geologic circumstances the use of continuous flight augers will provide an adequate drilling method.

b. Sampler Decontamination - In order to minimize the contamination of soil samples by the sampling equipment or through cross-contamination, all equipment must be thoroughly cleaned before their first use and also between samples.

Before a sampler is taken into the field it must be cleaned of any surface contamination by washing with a warm non-phosphate detergent solution (e.g., Liquinox or Alconox), rinsed several times with tap water, rinsed with 0.1N nitric acid when cross-contamination of metals is a concern, rinsed with purified water, and dried. Coatings, such as oils, which may have been applied to the surface to inhibit corrosion during storage must also be removed by washing with acetone and rinsing with warm water. Finally, the sampler should be rinsed thoroughly with clean water, dried, and wrapped in clean polyethylene foil for transport. Many disposable samplers are available which minimize the possibility of cross-contamination. The owner or operator may propose alternative decontamination procedures provided that justification is given.

Cleaning of the sampling equipment between samples is particularly important when:

- The sampled soil is wet and sticky;
- Soils with highly variable contamination are sampled; and
- Soils containing high concentrations of petroleum products or oil residues are sampled.

In the last case it is necessary to use organic solvents for cleaning samplers in the field. Isopropanol is recommended for this purpose.

Under normal circumstances, however, cleaning samplers with a brush and a detergent solution, followed by thorough rinsing with clean water and drying should be sufficient to minimize cross-contamination.

c. Sample Container - The soil sampling plan should identify the type of containers to be used for sample collection. When organics are the analytes of interest, glass bottles with Teflon lined caps should be used. When metal are the analytes of interest, polyethylene containers with polypropylene or polyethylene caps should be used. Glass bottles with Teflon lined caps may also be used for metals.

d. Bore Hole Sealing - The soil sample plan should describe procedures for backfilling and sealing borings to reduce the potential for cross-contamination or vertical contaminant migration.

5. Quality Control Samples - Each sample and each sample set must have quality control measures to establish the data's quality for each analytical result. The owner or operator should take the following quality control samples:

- Field Replicates - Replicate samples can be either co-located (collected consecutively from the same or adjacent location) or split (divided from on homogeneous sample), and are treated in an identical manner during storage, transportation, and analysis. Replicate samples allow for an estimate of variability from sampling through analysis. Samples analyzed for volatiles are co-located and not split in the field. At least 5% of all soil samples should be collected as replicates.

- Travel Blanks - Samples containing contaminant free matrices. These samples are placed and remain with the

other samples in the storage and transport containers to detect cross-contamination between samples. Travel blanks are vials normally filled with purified water at the laboratory. Travel blanks are needed only when testing for volatile compounds and should accompany each shipping container containing samples to be analyzed for volatiles.

! Equipment Blanks - Contaminant free matrices are passed over sampling equipment surfaces that contact the samples. These help to evaluate the proper cleaning of sampling equipment. One equipment blank per day for each type of sampling device is usually sufficient.

! Spiked Samples - These samples contain known concentrations of a contaminant in the sample matrix. They are analyzed along with field samples to demonstrate the method performance of the laboratory.

! Blind Spike Samples - These samples are the same as the spiked samples, except the concentration is not known to the analyst.

6. Chain-of-Custody - Chain-of-custody establishes the documentation and control required to identify and trace a sample from collection to completion of analysis, provides defensible proof of the sample and data integrity, and provides conclusive written proof that samples are taken, transferred, prepared, and analyzed in an unbroken line to maintain sample integrity.

The soil sampling plan should explain how chain-of-custody will be implemented and followed during all sampling and analysis phases. The following chain-of-custody information should be provided in the soil sampling plan:

a. Sample labelling.

b. Unique sample identification numbers.

c. Records of sample container preparation and integrity prior to sampling.

d. Records of the sample collection, such as, specific sample location; collection data; exact collection time; type of sample taken; other pertinent information; and initialing of each entry.

e. Types of container sealing method for tamper control.

f. Maintenance of samples, either in one's possession or under lock and key, to ensure security of sample custody.

g. Transportation or shipment of samples to the analysis laboratory.

h. Procedures for filling out the chain-of-custody records at all steps.

i. Procedures for accompanying the samples with the chain-of-custody.

j. Maintenance of records to support potential litigation (e.g., sample logs and shipping papers).

7. Sample Labelling, Packaging, and Transportation:

a. Labelling - Labels for all collected samples including replicates, field blanks, and spikes, should be filled out completely and affixed to the sample containers. The minimum information required on the label is:

- Site location
- Field ID number
- Collection date and time

- Collector name
- Preservation

b. Packaging - The soil sampling plan should describe how samples would be preserved during transportation. The owner or operator should comply with 49 CFR 209 and 40 CFR 136 for sample preservation. Generally, soil samples taken for organic analysis should be kept at 4 degrees celsius. No refrigeration is needed for soil samples taken for metal analysis. Sample containers should be packaged in sturdy boxes or ice-chests fill with packing material to maintain sample integrity during transportation.

c. Transportation - Many soil and solid samples are considered as environmental samples and should comply with DOT shipping requirements. The soil sampling plan should describe how soil samples would be transported to a designated laboratory (e.g., hand delivery, express postal service). A chain-of-custody must accompany with the soil sample at all time during transportation.

8. Documentation - The soil sampling plan should define the records required during sampling activity. The sampling team should maintain an official log book of the investigation. Observations of the field conditions, equipment used, procedures followed and crew members involved are recorded for each sampling activity. The log book should be bound and all data must be recorded in ink. Sketch maps, diagrams, and photographs of the site may be drawn or attached to the log book.

- Date and time of entry,
- Purpose of sampling,
- Sampling equipment use and procedures followed,
- Names and affiliation of all sampling team members,
- Name and address of field contact (federal, state, local [representative]),
- Description of sample,
- Waste components and concentration (if known)
- Actual number, location, depth, and size of sample taken,
- Description of sampling point,
- Date and time of sample collection,
- Maps or sketches or photographs of sampling site,
- Field observations,

Cautionary Note - The permit writer always has the option to request the facility to conduct soil sampling if they have reason to believe releases have already occurred. This would be done even before the closure plan is either submitted or approved. (This investigatory sampling is optional and can be required at the discretion of the permit writer if he/she knows or suspects that there have been releases from the regulated units and he/she wants to make sure sufficient funds are included in the closure cost estimate to remove/decontaminate these soils.) Such a determination might be based on operation record review and visual inspection. If operation records indicate major accidents, spills, or leakages of hazardous waste at the facility, or the results of visual inspection show obvious signs of contamination (e.g., discolored soils, cracked secondary containment system, odor), the owner or operator should take investigatory soil samples to assess the soil condition. Data generated from investigatory sampling provide a better basis to estimate the approximate extent of soil contamination to be factored into the closure cost estimate. Thus the facility's financial assurance mechanism will represent an accurate cost of closure/cleanup.

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List of Examples:

List of Attachments:

List of References:

List of Appendices:

Appendix B - random sampling procedure to determine a sample location